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DESCRIPTION

Magnetic Recording and Reproducing Apparatus

5 Technical Field

The present invention relates to a magnetic recording and reproducing apparatus which encodes audio and video (hereinafter referred to as A & V) data into digital form and records or reproduces the digital form.

10 Background Art

A digital recording and reproducing apparatus of A & V encodes an audio signal and a video signal into digital data, then rearranges a time-sequence of the data every certain amount of data, then the rearranged data is recorded into magnetic recording medium. The rearranged data is restored
15 to original time sequence when the data is reproduced.

The rearrangement at recording and its restoring at reproducing are referred to as "shuffling" and "deshuffling." This method is effective when parts of the data are dropped out due to scratches on the magnetic medium, because the drop-outs are not intensively gathered at one point but they are
20 dispersed. As a result, a time of audio discontinuity due to drop-out of data can be shortened.

When data is reproduced in a reverse direction by such a conventional magnetic recording and reproducing apparatus as discussed above, audio data deshuffled is once stored in a memory, then the data is read out in a reverse
25 order from the memory at given intervals. This is for realizing the same practice as a recording and reproducing apparatus having a linear audio track.

Fig. 3 is a block diagram of a deshuffling section of the conventional recording and reproducing apparatus.

The deshuffling section at the reproducing side shown in Fig. 3 comprises the following elements:

- 5 (a) video deshuffling circuit 4;
- (b) video deshuffling address generator 5 for instructing an order of video deshuffling;
- (c) audio deshuffling circuit 6;
- (d) audio deshuffling address generator 7 for instructing an order of
- 10 audio deshuffling;
- (e) data rearranging circuit 8 for reverse reproduction; and
- (f) switching circuit 9 for switching a signal responsive to data-reproduction-direction-signal 10.

Deshuffling circuit 4 and address generator 5 constitutes a video deshuffling
15 section.

An output data from deshuffling circuit 6 is stored in a built-in memory of data rearranging circuit 8. Circuit 6 reads the data at given intervals from the built-in memory in a reverse order to the storing order.

When the data is reproduced in a normal direction (reproduction in a
20 positive direction), switching circuit 9 is closed to contact 9a side, and output data is supplied from audio deshuffling circuit 6 as audio data. When the data is reproduced in a reverse direction, circuit 9 is closed to contact 9b side, and output data is supplied from data rearranging circuit 8 as audio data.

The conventional method discussed above requires the data
25 rearranging circuit having the built-in memory in order to rearrange the deshuffled audio data to reverse order when the data is reproduced in a reverse direction. As a result, this structure increases the cost. Further the

deshuffled audio data should be stored in a given period for rearrangement. On the other hand, deshuffled video data does not require the rearranging circuit. Therefore, the audio data is delayed with respect to the video data for a certain period due to the rearrangement. In general, this certain period
5 often corresponds to one frame of video data. Thus reproduction timings of video data and audio data do not agree upon each other.

Summary of the Invention

The present invention addresses the problem discussed above, and
10 aims to provide a digital recording and reproducing apparatus which does not need rearrangement of audio data after deshuffling at reverse reproduction and which can reproduce audio data at the same timing as video data.

A magnetic recording and reproducing apparatus, which rearranges digital data of A & V according to a given rule, has deshuffling means which
15 performs the following jobs in order to solve the problem. (a) Rearranging reproduction-data in a normal direction to an order before the shuffling, then outputting the data; and (b) rearranging reproduction-data in a reverse direction to an order reverse to the order before the shuffling, then outputting the data.

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Brief Description of Drawings

Fig. 1 is a block diagram showing a deshuffling section of a digital magnetic recording and reproducing apparatus in accordance with a first exemplary embodiment of the present invention.

25 Fig. 2 schematically describes the deshuffling of the apparatus in accordance with the first exemplary embodiment of the present invention.

Fig. 3 is a block diagram showing a deshuffling section of a

conventional magnetic recording and reproducing apparatus.

Detailed Description of Preferred Embodiment

(Exemplary Embodiment 1)

5 Fig. 1 is a block diagram showing a deshuffling section of a digital magnetic recording and reproducing apparatus in accordance with a first exemplary embodiment of the present invention. In Fig. 1, video deshuffling section 1 is the same as a conventional one. Fig. 2 schematically describes the deshuffling of the apparatus in accordance with the first exemplary
10 embodiment of the present invention.

In this embodiment, audio data in one frame of a video signal is divided into nine data blocks such as D1, D2,, D9, and this unit block undergoes shuffling or deshuffling.

15 The embodiment is described hereinafter with reference to Fig. 1 and Fig. 2.

An audio data block row (D1, D2, D3, D4, D5, D6, D7, D8, D9) is shuffled to block row 20 of which order is (D7, D2, D6, D4, D1, D5, D8, D9, D3), and recorded in a magnetic recording and reproducing apparatus.

20 When the data is reproduced, block row 20 is reproduced according to an order of its data blocks having been recorded, then the data is fed to deshuffling circuit 2, which stores each block of row 20—following the input order—into addresses a1, a2, a3, b1, b2, b3, c1, c2, c3 of built-in memory 29.

25 Address generator 3 for audio deshuffling follows input reproduction-direction-signal 10, and outputs a read-out address of memory 29. In other words, when signal 10 indicates a reproduction in a normal direction, address generator 3 outputs read-out address 31 of which order is b2, a2, c3, b1, b3, a3, a1, c1, c2. When signal 10 indicates a reproduction in a reverse direction,

address generator 3 outputs read-out address 32 of which order is c2, c1, a1, a3, b3, b1, c3, a2, b2.

5 Deshuffling circuit 2 reads data blocks stored in memory 29 following read-out addresses supplied. In other words, when read-out address 31 is input, data blocks are read out in the order of b2, a2, c3, b1, b3, a3, a1, c1, c2. As a result, audio data 21 is output in the order of D1, D2, D3, D4, D5, D6, D7, D8, D9. When read-out address 32 is input, deshuffling circuit 2 reads out addresses in the order of c2, c1, a1, a3, b3, b1, c3, a2, b2. Then audio data 22 is output in the order of D9, D8, D7, D6, D5, D4, D3, D2, D1.

10 As such, the present invention proves that an audio data rearranging circuit subsequent to deshuffling is not needed, and a timing shift between video data and audio data can be eliminated.

Industrial Applicability

15 A magnetic recording and reproducing apparatus of the present invention reverses an order of data rearrangement in a deshuffling circuit at a reproduction in a reverse direction to an order of a reproduction in a normal direction. Thus an audio-data-rearranging-circuit is not needed, and at the same time, A & V data can be reproduced free from timing shift
20 therebetween.